

Express Setup Guide: the Precipitation Imaging Package (PIP)

Lickety-Split

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The Task: an Operational PIP

Herein are basic instructions to do that.

If possible, learn to setup & to operate a PIP in a handy location.
Then move the camera and lamp outside for weather monitoring.

The [PIP User Manual](#) provides additional information.

C:\PIP\Software\User_Guide\PIP_User_Manual.pdf

Hardware Components

This PIP is located at the GPM field site at NASA Wallops Flight Facility.

Outside are (1) the high speed video-camera and (2) the halogen lamp.

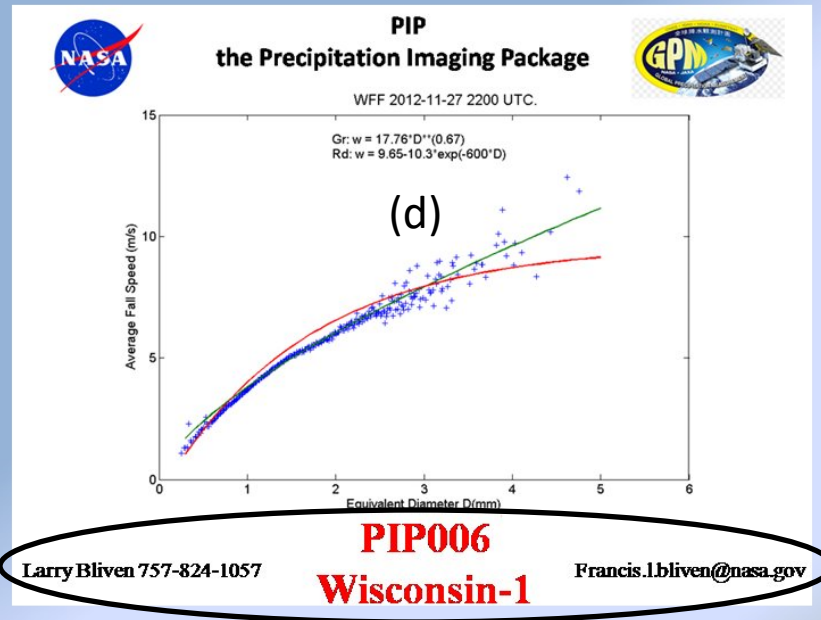
Inside there is (3) the PIP workstation, which is connected via (4) Ethernet cable to the camera.



PIP-PC Desktop



(a)



(b)

(c)



5:09 PM
7/20/2016

When a PIP-PC boots, the desktop should look like this one.

- (a) the PIP Tool Box connects to routine processes.
- (b) Handy reference stuff.
- (c) Icons of running PIP apps (video recording\processing).
- (d) The first rain event monitored by a PIP shows excellent agreement between measured fall speeds and models.

PIP Tool Box Primer

You select commonly used processes and products.

Note that by default, Button #20 displays this quick guide, which is also in the User Manual (#1).

PIP Tool Box

Button	Tip	Description
1. User Manual	How operate a PIP	1. Quick setup guide. 2. Operations Details 3. Example Data Products
2. Hardware	Lamp & Camera Details	Run National Instruments NI IMAQ app, which (a) enables physical alignment of camera to lamp, (b) adjustment of light intensity gain, and (c) setting of other camera options. Useful for PIP installation and then for periodically checking light bulb.
3. Setup File	Software Control File for all PIP Apps	Control all PIP Apps from a single setup file. ASCII text file. Descriptor, tab, the instruction. *Must* have tab!
4. Log File	Listing of PIP_3 operations.	Daily file shows PIP_3 progress by records containing time stamps and processing instructions. Useful for documentation and assessing system performance. Daily files are zipped to the Zip directory.
5. Dir	Directory of PIP Products	Windows Explorer to the root for data products from PIP-1, PIP-2 and PIP3.
6. Movie Now	Recent Precipitation AVI	(1) To see what recent precipitation looks like, goto the most recent precipitation AVI, which is C:\PIP\Current_Weather\Recent_Lar.avi.zip. (2) Note that largest AVI for each 10 minute interval is located in root_1\PIP_3\F_10_Summary\Movies, where Analysis Root Directory_1 is defined in the Setup File. (3) AVIs for each minute of precipitation are in root2\PIP_2\q_Viewer, where Analysis Root Directory_2 is defined in the Setup File.
7. Figures All	Daily Summary Figures	DSD, Vel, eDen, P Summary Plot for each days. This 4-Figure presentation displays the basic input and output, i.e. DSD & Vel distributions, as well as the volume average density by minute and the rain & not-rain precipitation rates by minute. Additionally, Rain and not-Rain accumulations are presented.
8. Figures Now	Today's Summary Plot	Current Conditions: DSD, Vel, eDen, P Summary Plot. This 4-Figure presentation displays the basic input and output, i.e. DSD & Vel distributions, as well as the volume average density by minute and the rain & not-rain precipitation rates by minute.. Additionally, Rain and not-Rain accumulations are presented.
9. PSD Vel	Daily PSD & Velocity Summary	Time history of PSD, Fall Velocity, Relative Fall Velocity and Fall Speed Variability. Visual display of storm characteristics.
10. Vel	Today's 10 Minute Fall Velocity Plots	Fall Speed by Size for each 10 minute increment. Visualization of storm evolution by particle size. Rain and not-rain fall speed changes are useful for seeing frontal passage and other features. See (a) root_1\PIP_3\F_2_3_1_Velocity_Ebar and (b) root_1\PIP_3\F_2_3_0_Velocity_Plots_seg for mean & error bar, as well as individual particle fall speeds. For daily archiving, these are zipped to the Zip directory.

PIP Tool Box

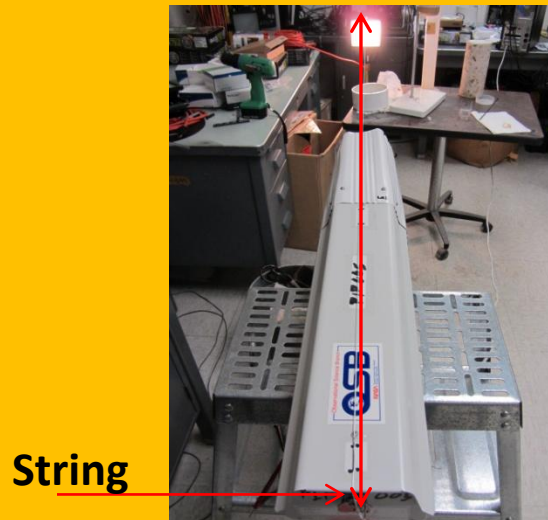
Button	Tip	Description
11. Task Mngr	What's running?	Windows Task Manger shows which Apps are running.
12. Scheduler	Schedule Startup Apps	Run Windows Scheduler and Goto PIP subdirectory. Turn on PIP startup apps (Tool_Bar and PIP_123). Note that Tool_Bar is always useful, however for setup, PIP_123 should not be running. Use button 14. Kill PIP as necessary.
13. Run PIP	*Run* PIP App	Run PIP_1, PIP_2, PIP_2a, and PIP_3 apps as desired.
14. Kill PIP	*Kill* PIP Apps	Kill PIP_1, PIP_2, PIP_2a, and PIP_3 apps as desired.
15. Re-Start PIP	*Re-Start* PIP Apps	Re-Start PIP_1, PIP_2, PIP_2a, and PIP_3 apps as desired.
16. PC Health	Monitor PC Temperature	Check Temps to ensure cool operations, i.e. don't want to see temperatures in the 60's degree C.
17. Fig/Tables Web	Figures and Tables for Web	Daily tables and figures in one place enables backup and web distribution.
18. Movie Web	Movies for Web	Daily AVI's enables backup and web distribution.
Button_19.bat	Link to an app of your choice	This button links to: C:\PIP(Software)\Setup\Tools_16\button_19.bat At NWS-MQT, links to URL for MRR-PIP daily figures.
Button_20.bat	Link to an app of your choice	This button links to: C:\PIP(Software)\Setup\Tools_16\button_20.bat At NWS-MQT, links to this file.



Mouse Roll Over = Tip
Right Click = Description

Initial Alignment

A string provides rough alignment between the camera housing and the lamp.
Then go to Fine Alignment (next page).




Fine Alignment

Adjust things so that light from the halogen lamp is centered.
Move the camera and/or lamp to get the NI-MAX image to look like this one,
Then adjust the Gain (next page).

The screenshot shows the NI-MAX software interface. On the left, the 'My System' tree is expanded to 'cam0 : Basler piA640-210gm'. Red arrows point to this entry (labeled 1) and the 'Grab' button (labeled 2). The main window displays a grayscale image of a light source. Red arrows point to the image (labeled 3) and the 'Histogram' button (labeled 4). The histogram shows a peak around 100 pixel values. Below the image, camera details are listed: Name: cam0, Vendor: Basler, Model: piA640-210gm, Serial Number: 0x0000003053151020, Bus Type: Ethernet, IP Address: 169.254.33.16. At the bottom right, the status bar shows 'Frames per second: 178, 379 (displayed, acq...'.

Step 1 requires the PC to gather information and takes a moment to complete.

Frames per second acquired Should be ~380 fps. If not, goto 

Frames per second: 178, 379 (displayed, acq...

Gain

Adjust the Gain so the histogram looks like this one, i.e.
Max ~220 & min ~50. Want >200 but never saturate (>255).

5. Save

Be sure to ***Save***.

6. Exit

The screenshot shows the NI-IMAQdx Basics software interface. At the top, there's a menu bar with File, Edit, View, Tools, and Help. Below it is a toolbar with buttons for Save, Revert, Snap, Grab, Histogram, and Save Image. The main window is divided into several sections. On the left, there's a tree view showing the system hierarchy. In the center, there's a large image area. On the right, there's a histogram window showing the distribution of pixel values. Below the image area, there's a section for Camera Attributes, which includes Analog Controls, Image Format Controls, AOI Controls, and Acquisition Controls. The Gain (Raw) control is highlighted with a red box and a red arrow pointing to it. The Gain (Raw) control has a dropdown menu with options: Off, All, 33, 0, User, 1.00000000, 0, Mono 8, 8 Bits/Pixel, No Filter, 0, 255, Test Image Off. The Gain (Raw) control is currently set to 33. A red arrow points from the histogram window to the Gain (Raw) control. The histogram window shows a bell-shaped curve with a peak around 150. The x-axis is labeled 'Pixel Value' and ranges from 0 to 300. The y-axis is labeled 'Number of Pixels' and ranges from 1 to 10000. The histogram window also has a 'Log' checkbox. The bottom status bar shows 'Frames per second: 236, 379 (displayed, acquired)'.

1. Grab
2. Histogram

3. Attributes

4. Adjust Raw Gain to get histogram like above.

3.1 Confirm and reset if needed.
It is unusual for these to change.

Frames per second acquired
Should be ~380 fps.
If not, goto **Tips**

When you are sure that settings are saved, you are ready to run PIP Apps.

If you ***can not*** set them as needed, goto **Tips**. (Other settings sometimes change during shipment.)

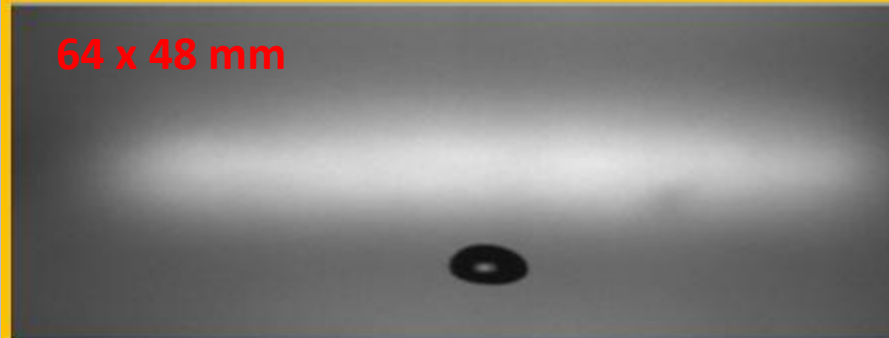
Falling Drops

This step is optional. It is useful to demonstrate video operation.
Setup a dripper so that water drops fall in the focal plane,
Which can be located by a knot along the string.

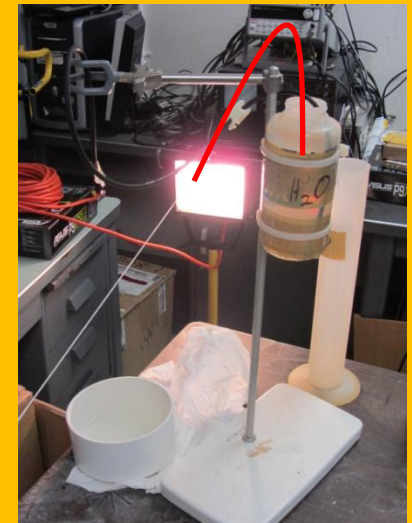


Water Drop

Looks Distorted due to 2 to 1 resolution.
PIP Apps account for this.



Tube Siphons Water for Dripper

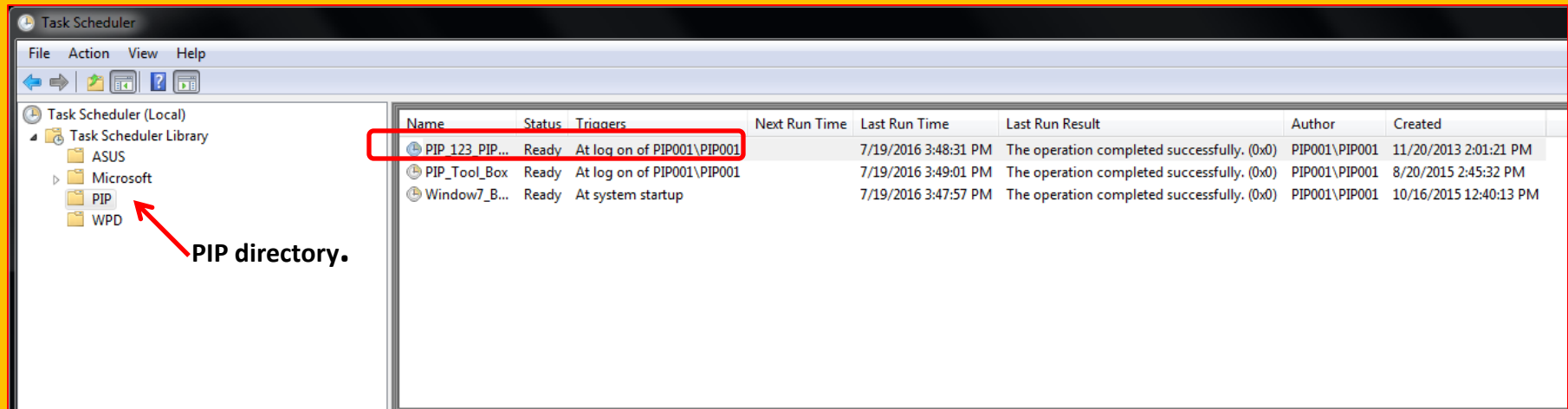


PIP_1 App has pixel by pixel Automatic Gain Control (AGC)
That adjusts for non-uniform brightness,
So that grayscale thresholding is effective for image compression.

Scheduler

12. Scheduler

Schedule PIP to run at boot,
Which is useful after power failures because PIP apps will run whenever power is restored.
Run the Windows Task Scheduler program.
Change Status of PIP_123 to Enabled (right click).
>> exit program. Re-boot. PIP should come up running the PIP Apps.



Checkered Flag

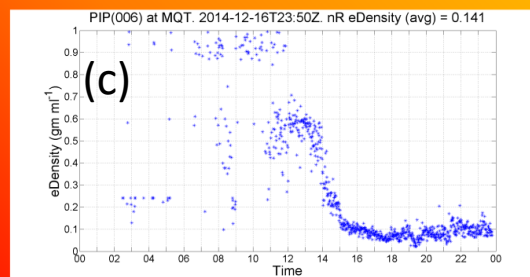
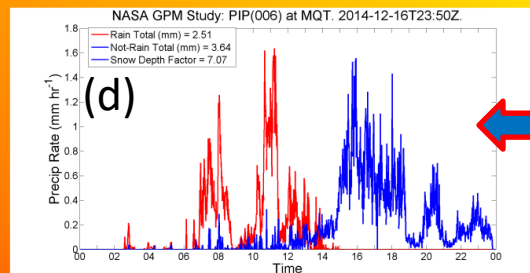
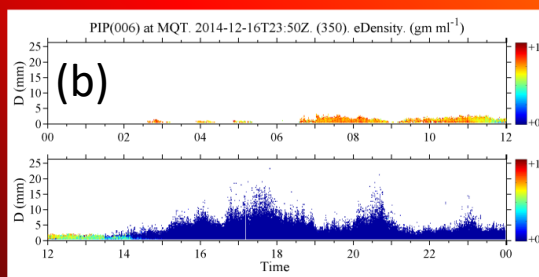
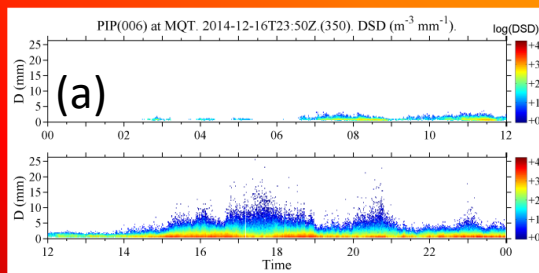
i.e. recording video input and producing products.

At ~10 minute points (maybe delayed during precip), graphs popup on screen.

Tool Box Buttons 4-10 provide access to lots of stuff.



PIP at MQT. 2014/12/16.



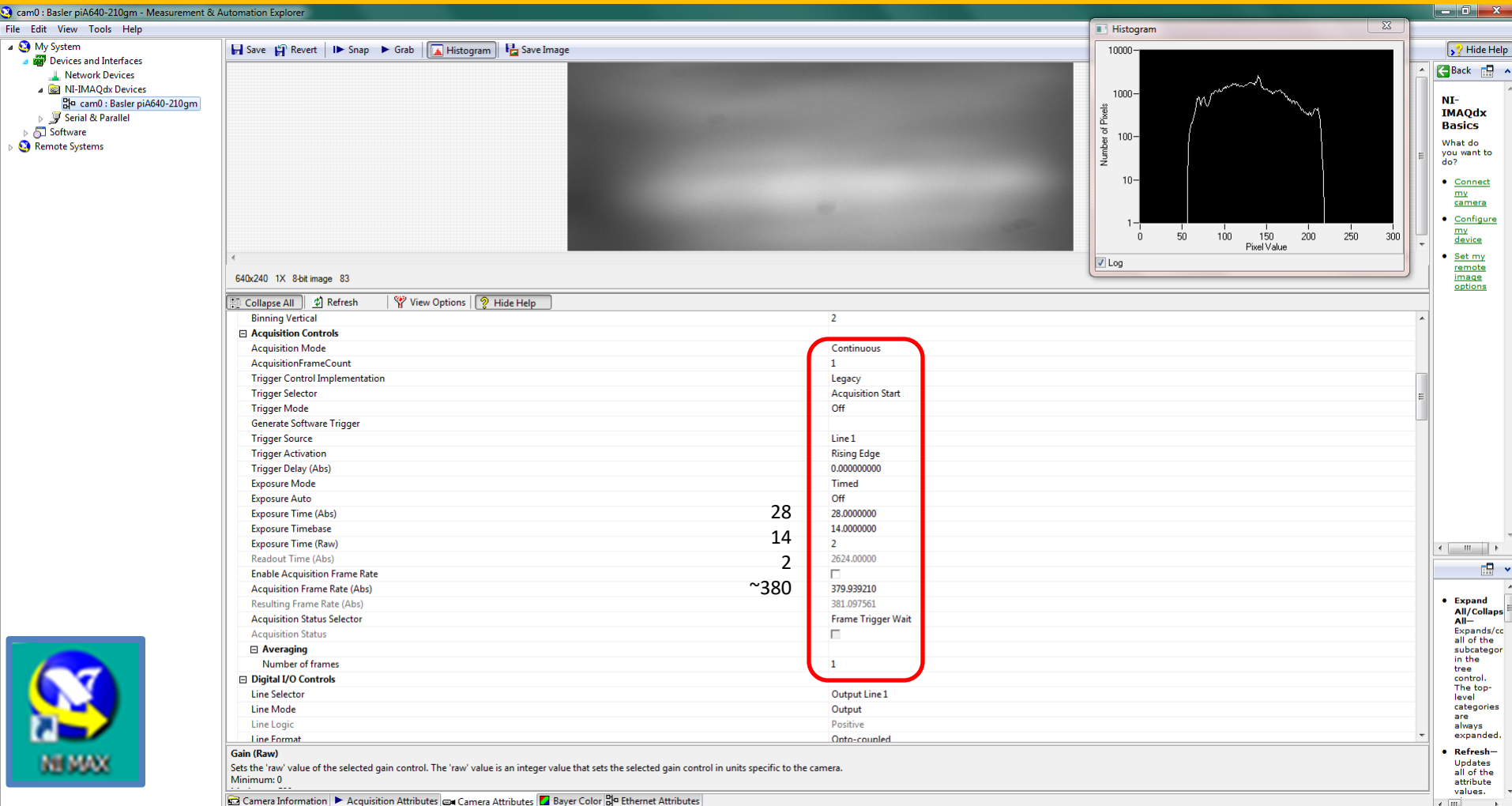
Rain and not-Rain
Measured
Independently and
Simultaneously!

Time Series
Of not-Rain
Density
(Cold Front)

High Speed Video Images Yield
(a) Particle Size Distributions
(b) Fall Velocity Distributions

Models Produce
(d) Rain & not-Rain Water Flux
(c) Density Estimates

Tip: Camera exposure settings (advanced).
Confirm that your settings are as shown.
These are needed for exposure time and frame rate!
After adjustments, [GoTo](#).



cam0 : Basler piA640-210gm - Measurement & Automation Explorer

File Edit View Tools Help

Save Revert Snap Grab Histogram Save Image

640x240 1X 8-bit image 83

Collapse All Refresh View Options Hide Help

Binning Vertical

Acquisition Controls

Acquisition Mode

AcquisitionFrameCount

Trigger Control Implementation

Trigger Selector

Trigger Mode

Generate Software Trigger

Trigger Source

Trigger Activation

Trigger Delay (Abs)

Exposure Mode

Exposure Auto

Exposure Time (Abs) 28

Exposure Timebase

Exposure Time (Raw) 14

Readout Time (Abs) 2

Enable Acquisition Frame Rate

Acquisition Frame Rate (Abs) ~380

Resulting Frame Rate (Abs)

Acquisition Status Selector

Acquisition Status

Averaging

Number of frames

Digital I/O Controls

Line Selector

Line Mode

Line Logic

Line Format

Gain (Raw)

Sets the 'raw' value of the selected gain control. The 'raw' value is an integer value that sets the selected gain control in units specific to the camera.

Minimum: 0

Camera Information Acquisition Attributes Camera Attributes Bayer Color Ethernet Attributes

2

Continuous

1

Legacy

Acquisition Start

Off

Line 1

Rising Edge

0.00000000

Timed

Off

28.00000000

14.00000000

2

2624.000000

379.939210

381.097561

Frame Trigger Wait

1

Output Line 1

Output

Positive

On-to-counted

Number of Pixels

Pixel Value

Log

NI-IMAQdx Basics

What do you want to do?

- Connect my camera
- Configure my device
- Set my remote image options

Expand All/Collapse All—Expands/collapses all of the subcategory in the tree control. The top-level categories are always expanded.

Refresh—Updates all of the attribute values.

Frames per second: 236, 379 (displayed)

End of PIP Express Setup Guide